NOTES ON A COLLECTION OF SMALL MAMMALS FROM NORTHEASTERN NORTH CAROLINA.

BY SAMUEL N. RHOADS AND ROBERT T. YOUNG.

The series of small mammals forming the basis of the following paper was recently collected by Mr. Young, and, with the exception of about fifteen specimens donated to Dr. C. Hart Merriam,[1] was presented to the senior author prior to Mr. Young's departure to the far west in the interests of the U. S. Department of Agriculture. Since leaving Philadelphia Mr. Young has forwarded to the Academy of Natural Sciences copious notes on his itinerary and the faunal and floral features of the country where the collection was made, besides his personal observations and a list of all the species of mammalia coming under his notice.

Owing to the hurried preparation of these notes it has been thought best to entirely rewrite and rearrange them for publication in the following form. Where Mr. Young's notes are given verbatim they appear in quotation marks without additional reference. Quotations from other sources will be specially referred to under their several author's names.

"The points visited were Chapanoke, Perquimans County, from March 8th to 24th, (1897), and Currituck, Currituck County, from March 27th to April 14th, two days being also spent at Elizabeth City, Pasquotank County. Chapanoke is about eighteen miles from Albemarle Sound, a small stream which drains the swamp-land in this vicinity flowing thence into the Sound. Currituck is situated directly on Currituck Sound, the waters of which, as well as those of Albemarle Sound, are nearly fresh. The country through all this section of North Carolina is mainly low and swampy, the interior upland soils being a fertile sandy loam, while those of the lowlands along the Sounds are chiefly sand. Most of the land is cultivated, although considerable timber still remains in the swamps. The swamp-lands during winter and spring are usually under from one to four feet of water, but in summer they are nearly dry. The

[1] Dr. Merriam very kindly furnished a list, with annotations, of the species sent to him by Mr. Young, for use in this connection.—S. N. R.

principal timber growths of the swamps are Cypress, Gum, Oak, Swamp Maple and Birch, with some Dogwood, Elm and Ash. The upland timber consists mainly of two species of short-leaved Pine with abundant undergrowth of Holly, *Ilex glabra*, though in some places are extensive tracts of Juniper. Along the Sound coast Holly and Laurel grow abundantly, the shores of Currituck Sound being also here and there dotted with Alders. One of the chief woodland plants is *Apios tuberosa*, and the green briar makes itself obnoxious wherever one may chance to wander. In marshy spots and along the ditches which have been dug for draining the fields, Cane, *Arundinaria tecta*, occurs abundantly, and in many places in the woods is a soft carpet of *Hypnum* moss. In this moss were found several mice and one or two shrews. A few of the trees in the low woods and swamps were adorned with Spanish moss (*Tillandsia*), but this is not common. The Yellow Jasmine was also abundant and blooming. Along Currituck Sound are extensive marshes covered with cat-tails and a thick dense *Juncus* (?) 2 to 3 feet high. A small patch of *Juncus setaceus* at Chapanoke contained runways in which were taken two specimens of *Synaptomys*. But little success in trapping was had at Chapanoke, small mammals apparently being quite scarce."

The region covered by Mr. Young's researches is of much faunal interest, being the borderland of distribution between such distinctively Carolinian forms as *Reithrodontomys humilis*, *Peromyscus aureolus* and *gossypinus* and *Sorex longirostris*, and the wider ranging northern species *Peromyscus leucopus*, *Microtus pennsylvanicus* and *Sorex personatus*. The faunal and floral conditions on Albemarle Sound are further complicated by the presence of the Great Dismal Swamp and its confluents, whose peculiar environment is a strange combination of boreal and austral in a territory whose normal climate is decidedly austral. The proximity of this region to the sea also has a decided effect in equalizing the relative temperature and average humidity of summer and winter as compared with the interior uplands in this latitude.

Dr. Merriam has recently described a *Synaptomys*, a *Blarina* and a *Sorex* all taken by Dr. A. K. Fisher in Dismal Swamp, and, while it is doubtful if all of these will prove specifically distinct from their nearest northern or southern affines, there is undoubtedly a most marked contrast between these swamp dwellers and their nearby associates of the uplands.

The following is a list of the species seen or obtained by Mr. Young, with annotations on each.

1. **Lepus**——sp?. Hare.

"Only a few individuals of this genus were noted. They were probably *sylvaticus*, but as none were secured this is uncertain. *L. palustris* may also occur."

2. **Synaptomys cooperi stonei** (Rhoads). Carolinian Bog Vole.

Synaptomys helaletes Merriam. Proc. Biol. Soc. Washn., 1896, p. 59.

"Two specimens, male and female, the latter containing four well advanced embryos, were taken in a patch of *Juncus setaceus* in a damp piece of open ground bordering pine woods at Chapanoke, March 11, 1897. The runways were filled with cut stems of the *Juncus*, on which they had evidently been feeding."

The identification of these *Synaptomys* has necessitated a careful examination of a series of about forty accurately measured and well preserved skins and skulls of *cooperi* from eastern North America from New Brunswick to Roan Mountain, North Carolina, a few of which are in the collection of the American Museum of Natural History, New York, but the majority were collected by the senior author in Pennsylvania and New Jersey. By means of this exceptional series from the debatable region lying between the northern and southern extremes of the eastern distribution of *cooperi*, together with the data presented by Dr. Merriam's "Revision" of the genus (*l.c.*), the following conclusions have been reached:—

1. The type locality of *Synaptomys cooperi*, according to the known history of the original (type) specimen and the published consensus of recent naturalists, may be defined as lying within a radius of fifty miles of Hoboken, New Jersey, either in northern New Jersey, southern New York or eastern Connecticut.

2. *Synaptomys cooperi* Baird, is represented by the following species and subspecies:—

a. Cooper's Bog Vole. *Synaptomys cooperi* Baird; Mam. N. Amer., 1857, pp. 556–558.

Type locality unknown; probably northern New Jersey or southern New York.

Geographic distribution.—Lower Alleghenian fauna,[2] intergrading southwardly into subspecies *stonei*, northwardly into subspecies

[2] Dr. J. A. Allen's nomenclature of faunal areas is here used.

fatuus, and westwardly into subspecies *gossi*.

General characters.—Similar in colors and appearance to *Microtus pennsylvanicus*, but smaller and with a very short bicolor tail. Contrasted with *S. c. stonei* the body measurements are somewhat less, but in the same proportions. The skull of *cooperi*, however, is relatively smaller than in *stonei* and the dentition much weaker. The relative proportions of the skull in *cooperi* are about the same as in *fatuus*, but the rostrum and mandibles of *stonei* and *gossi* are relatively much broader and more massive.

Measurements.—Average of 3 old adult females and 2 old adult males from Sussex County, New Jersey and Monroe and Cambria Counties, Pennsylvania; total length 118 millimeters; tail vertebræ 16.5; hind foot 19.5. Skulls of 2 adult males, Sussex County, New Jersey and Monroe County, Pennsylvania; greatest length 26.5; greatest breadth 16.

b. Canadian Bog Vole. *Synaptomys cooperi fatuus* (Bangs); Proc. Biol. Soc. Washn., 1896, pp. 47, 48.

Type locality.—Lake Edward, Quebec.

Geographic distribution.—Lower east Canadian and upper Alleghenian faunas.

General characters.—As in *cooperi*. Skull much smaller and dentition relatively weaker. Under parts washed with buff on belly (not clear gray or plumbeous-gray as in *cooperi*). Tail nearly unicolor.

Measurements.—Average of 2 adults from type locality (fide Bangs); total length 124 m. m.; tail vertebræ 18; hind foot 18.7. Skulls of 2 adult males from type locality (fide Bangs); greatest length 25; greatest breadth 15.6.

c. Carolinian Bog Vole. *Synaptomys cooperi stonei* (Rhoads); Amer. Nat., 1893, pp. 53, 54.

Type locality.—Mays Landing, Atlantic County, New Jersey.

Geographic distribution.—Sphagnum bogs of the Carolinian fauna.

General characters.—Similar to *cooperi*, but somewhat larger with much larger and more massive skull and broader rostrum and incisors. Colors darker, especially on the underside, which is more plumbeous or slaty (less hoary) than in *cooperi*.[3]

[3] The 2 specimens taken at Chapanoke, however, are much lighter than average *cooperi*.

Measurements.—Average of nine adults, 4 females and 5 males, from the following localities: New Jersey, Cumberland County, 3; Cape May County, 1; Atlantic County, 3; North Carolina, Perquimans County, 2; total length 125 m. m.; tail vertebræ 20; hind foot 20. Skulls of two adult males from southern New Jersey; greatest length 27.8; greatest breadth 17.7. A large adult male skull from Chapanoke, North Carolina, is 28.5 millimeters long by 18 broad, and represents the extreme maximum size of the Dismal Swamp form which Dr. Merriam named (*l. c.*) *helaletes*.

d. Great Plains Bog Vole. *Synaptomys cooperi gossi* (Merriam). Proc. Biol. Soc. Washn., 1896, p. 60.

Type locality.—Neosho Falls, Kansas.

Geographic distribution.—Great Plains fauna.

General characters.[4]—Similar to *cooperi* but larger, with relatively small audital bullæ. Dentition heavy, as in *stonei*. Color above, decidedly shaded with reddish-brown.

Measurements.—Average of 6 specimens from type locality; total length 120 m. m.; tail vertebræ 20.5; hind foot 19. Skull measurements, not available.

3. Microtus pennsylvanicus nigrans Rhoads, subsp. nov. Albemarle Meadow Vole.

Type, No. 3,494 ad. ♀, Col. of S. N. Rhoads. Collected by R. T. Young at Currituck, Currituck County, North Carolina, April 7, 1897.

General characters.—Similar to *Microtus pennsylvanicus* of eastern Pennsylvania and New Jersey, but larger and darker, with a nearly unicolor tail and distinctly sulcate upper incisors in the majority of adult skulls.

Colors.—Above dark brownish slate-black, with a well defined darker median dorsal area of slaty-black, but sparingly mixed with the dark brown of sides. Dark brown of sides extending around and over lower parts from lips to vent, leaving no line or area of demarcation between upper and lower body colors as in *pennsylvanicus*, and in the series of 9 specimens examined, showing little trace of the ashy or hoary cast of underparts so conspicuous in 90 per cent. of a large series from eastern Pennsylvania, northward. Cranial characters as in *pennsylvanicus*.

[4] These characters and measurements are chiefly summarized from Dr. Merriam's "Revision" of the genus. I personally examined all the Goss specimens and can confirm the color diagnosis.—S. N. R.

Measurements.—(of type) Total length 175 m. m.; tail vertebræ 50; hind foot 23; ear, from crown 9. Average of 4 adults from Currituck: total length 176; tail vertebræ 50; hind foot 23; ear 8. Average of 4 adults from Philadelphia County, Pennsylvania (type locality): total length 165; tail vertebræ 44; hind foot 21; ear 9. Skull (of type): total length 29; greatest breadth 16.2; length of mandible 18.

A very large series, comprising nearly 500 specimens of *pennsylvanicus* from the eastern States and Canada, makes it possible to define accurately the variations in *M. pennsylvanicus*. A study of this material shows clearly a diminution in size and intensity of coloration as we go northward from the southern border of its range. Typical *pennsylvanicus* from Philadelphia County is exactly intermediate between the large meadow mice of eastern North Carolina and the small ones of Quebec and the lower Hudson Bay regions. The lightest colored eastern individuals come from the sea coasts of New England and represent an imperfectly differentiated race approaching *M. breweri*, easily distinguishable from the darker animal of the interior uplands of New England and the maritime coasts of New Jersey. It is possible that the Albemarle Vole, like its associates, *Sorex fisheri* and *Blarina telmalestes*, will be found to have no connectant habitat with its northern representative, *M. pennsylvanicus*, but prove to be an insulated species.[5] So far as I can discover, the type locality of *M. p. nigrans* is much farther south than any previously recorded habitat of *pennsylvanicus* on the Atlantic seaboard.

Thirteen specimens, nine adult, were preserved. They were all taken at Currituck where they are abundant, being "obtained in the *Juncus* and grass of marshy fields as well as in marshy patches of ground where mint and other weeds, on which they fed, were abundant."

4. Microtus pinetorum (LeC.). Pine-woods Vole.

A series of seventeen skins of this species from Currituck, which we may consider nearly typical of LeConte's animal, when compared with like series from more northern and mountainous localities in Pennsylvania and New Jersey, do not indicate, either in color or

[5] A specimen of this race from near the York River in Gloucester County, Virginia, taken by Mr. Rhoads since the above was written, indicates a continous distribution along the coast.

measurements, that the so-called *scalopsoides* of Bachman is even a tenable subspecies.

South Carolina and Georgia specimens, however, may show greater differences. Owing to the highly fossorial habits of this vole, spending like a mole nearly its whole life underground, it is not subjected to the ordinary vicissitudes of environment which have caused subspecific variations in other members of its family.

"Common at Currituck, where they were obtained in runways in the escarpment along shore and in the *Juncus* in wet woods along the shore."

5. Fiber zibethicus (L.). Muskrat.

Concerning the only specimens of this species, sent to him from Currituck, Dr. Merriam informs me by letter: "The muskrat has the small teeth of the ordinary *zibethicus*, thus differing from the Dismal Swamp form.

"Muskrats were reported as fairly common at Chapanoke. None were taken there, but at Currituck they were numerous in the marshes, where two specimens were secured."

6. Peromyscus leucopus (Raf.). Carolinian Deer Mouse.

Twelve skins from Chapanoke and ten from Currituck represent this species. They do not differ in color and measurements from a large series taken at the same time in southern New Jersey, which are considered typical of Rafinesque's species.

"The commonest species met with, being taken in all kinds of situations."

7. Peromyscus gossypinus (LeC.). Northern Cotton Mouse.

Two adult specimens from Currituck are the most northern record of this species known to us. The strong distinctions, both cranial and external, separating this species from its small congener and associate *leucopus* at Currituck, are apparent at a glance. The habitat of the two overlaps at this point precisely as it was found to do by the senior author in the bottom lands of western Tennessee, where the *mississippiensis* form of *gossypinus* occurs.

The specimens were "obtained in a patch of *Juncus* in a wet piece of woods on Currituck Sound."

8. Peromyscus aureolus (Aud. & Bach.). Golden Deer Mouse.

Four specimens from Chapanoke are in the collection.

9. Reithrodontomys humulis (Aud. & Bach.). Eastern Harvest Mouse.

Sixteen skins, two only of which were taken at Chapanoke, are in the Rhoads' collection. "Several specimens were taken at both

Chapanoke and Currituck. At the latter place the conditions were more favorable and they were much more common. Here they were trapped in marshy meadows grown up with *Juncus* and grass. Such places are scarce at Chapanoke, and there they were also obtained in cultivated fields and in patches of *Hypnum* in the pine woods."

10. Mus musculus (L.). House Mouse.

Two skulls and one skin of this foreigner are in the collection. No label is attached to the skin, but from the numbers on the skulls they evidently were taken at Chapanoke.

11. Sciurus carolinensis Gmel. Carolinian Gray Squirrel.

No specimens taken. "Only one observed at Currituck, but reported to be fairly common in all localities."

12. Putorius vison lutreocephalus (Harl.). Carolinian Mink.

"Several skins seen, which had been taken at Chapanoke, but no specimens obtained either there or at Currituck. They were reported as common in suitable localities at each place. They are considered very destructive to poultry."

13. Procyon lotor (L.). Raccoon.

"Reported to be fairly common. One or two skins were seen, taken near Chapanoke."

14. Blarina telmalestes Merr. Dismal Swamp Mole Shrew.

Three skins with skulls, two from Chapanoke and one from Currituck, represent this animal. The Currituck specimen is stated to have been "obtained in a patch of *Juncus* in a wet piece of woods near the Sound." The Chapanoke pair were taken in "moss in pine woods," according to attached labels. The latter, in measurements and skull characters, agree essentially with *brevicauda* of Pennsylvania, showing no tendency to the much smaller size of *carolinensis*, two specimens of which were obtained in the same locality (Chapanoke) and in a very similar kind of place. The Currituck specimen corresponds very closely to Dr. Merriam's diagnosis of *telmalestes*, having a larger foot and light colored teeth.

If we assume that *telmalestes* is an isolated swamp species unconnected with the habitat of *brevicauda* (an opinion which we are inclined to think a correct one), the existence of a large *Blarina*, like *brevicauda*, and the small species (or subspecies?) *carolinensis* at Chapanoke in the same kind of woods, is somewhat puzzling when

we consider that *brevicauda* and *carolinensis* have been pretty conclusively proved to intergrade in western North Carolina and Tennessee. For the present, however, it is more logical to assume that the two so-called '*brevicauda*' specimens from Chapanoke are immature *telmalestes*, that *telmalestes* does wander beyond the confines of swamps and that it in no case intergrades with its neighbor *carolinensis* nor ever overlaps the habitat of *brevicauda*, from which it should, therefore, be considered a distinct species.[6]

15. Blarina brevicauda carolinensis (Bachm.). Carolina Mole Shrew.

The difference in size between the small adult mole shrew from Chapanoke in the Rhoads' collection and the large specimens already referred to under *telmalestes*, is so great as to allow no question of a possible intergradation. The skull of the former barely measures 19 mm. in total length, while the latter average nearly 23 mm. The hind foot of the former is 11 mm. long, that of the latter 14 mm.

16. Sorex fisheri Merr. Fisher's Shrew.

"One specimen was secured in a runway in pine woods at Chapanoke." The color and measurements of this specimen, which is just reaching maturity, are intermediate between those given respectively for *longirostris* and *fisheri* in Dr. Merriam's "Revision" of the genus. The two may eventually be found to intergrade on the outskirts of Dismal Swamp.

SUPPLEMENTARY LIST OF SPECIES NOT OBSERVED BY MR. YOUNG BUT REPORTED TO HIM BY OTHERS.

1. Didelphis marsupialis virginiana (Kerr). Virginia Opossum.

"Said to be common at both Chapanoke and Currituck."

2. Dorcelaphus americanus (Erxl.) Virginia Deer.

"Said to be not uncommon in the wild regions about Chapanoke."

3. Sciuropterus volans (L.). Carolinian Flying Squirrel.

"Reported at Chapanoke."

4. Ursus americanus Pallas. American Black Bear.

"Not rare in the wilder sections of country near Chapanoke."

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[6] A specimen of typical *brevicauda*, recently taken in eastern Gloucester County, Virginia, indicates not only that *telmalestes* is connected with the northern form but that *carolinensis* is a distinct species whose habitat overlaps *brevicauda* in these regions.

5. **Lutra hudsonica** Lacèp. North American Otter.

"A few reported from the swamps around Chapanoke."

6. **Putorius noveboracensis** Emmons. Carolinian Weasel.

"Reported at Currituck. Probably occurs sparingly throughout the Albemarle region."

7. **Lynx ruffus** (Gueld.). Eastern Bay Lynx.

"Rare, but of general distribution."